IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Brad Geving Kris Alan Schmidt Kenneth J. Newell	Docket:	USA.342-1
Serial No.:	10/791,079	Art Unit:	1752
Filed:	March 2, 2004	Examiner:	Mai, Ngoclan Thi
Assignee:	3D Systems, Inc.	Conf. No.	2949
Title:	METAL POWDER COMPOSITION FOR LASER SINTERING		

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APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In the matter of the above-identified application for Letters Patent and in response to the Final Office Action dated September 30, 2005 the following Appeal Brief is submitted.

1. Please charge the amount of $250.00 to 3D Systems' Deposit Account No. 20-0900 to cover the filing fee for this Appeal Brief. If there are any additional charges associated with this Appeal Brief, please also charge them to Deposit Account No. 20-0900.

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REAL PARTY IN INTEREST

The real party in interest is 3D Systems, Inc. of Valencia California.

RELATED APPEALS AND INTERFERENCES.

There are no related appeals or interferences associated with the pending appeal.

STATUS OF CLAIMS

Claims 1-7, 9-15, 32 and 34-51 are pending in the application and these claims (1-7, 9-15, 32 and 34-51) are finally rejected.

STATUS OF AMENDMENTS

There have been no amendments filed subsequent to the Final Rejection of claims.

SUMMARY OF CLAIMED SUBJECT MATTER

The subject matter of the claims is a metal powder blended with or coated by a polymeric binder system and also includes a high melting temperature fine particulate metallic, intermetallic or ceramic. The metal is a steel alloy and can be a stainless, carbon or a low alloy or mild steel. The metallic powder blend is used to fabricate a three-dimensional object or article by selective laser sintering of the blended metal powder to form a "green" article. The term "green" refers to the intermediate state of the article, prior to its densification by infiltration. A more detailed description of this subject matter can be found in the specification beginning on page 12 line 1 and extending through page 14 line 20. The discussion includes Figure 1.

The salient aspect of the present invention is the low level of binder used in the laser sintering metallic powder blend which has a standard metallic component among the three ingredients with the following critical limitations:

1. a steel alloy of about 88.75 to about 92.75 percent by weight selected from the group consisting of a mild steel, a carbon steel and a stainless steel;

2. a polymeric binder from about 1.25 to about 2.25 percent by weight; and

3. a high melting temperature fine metallic, intermetallic or ceramic particulate of specified weight.

These are found in the two independent claims 1 and 36. See page 12, lines 21-27, page 13, line 29 to page 14, line 4 and page 18, line 25 for basis in the specification for these claims limitations.

Not all size steel alloy particles can be employed because of the gouging or streaking that occurs during the powder spreading step in the laser sintering powder bed from particles that are too large. Claims 2-5 and 37-39 further limit the size and shape of the steel alloy. Claims 35 and 51 further limit the class of

steel alloy. See page 13, lines 4-13 for basis in the specification for these claim limitations.

A high melting temperature fine particulate metallic, intermetallic or ceramic material must also be selected with sensitivity to size because of the potential for powder bed gouging or streaking, as well as for the effect of distortion on the finished article that is infiltrated to greater density. Claims 6, 7, 9, and 40-42 further limit the size and weight percent of this ingredient. The composition of this ingredient is further limited in claims 32, 34, 49 and 50. See page 13, line 29 to page 14, line 7 and lines 21-22 for basis in the specification for these claim limitations.

The critical limitations concerning independent claims 1 and 36 are further limited in claims 10-13 and 43-46. An essential feature of the laser sintering metallic blend is that the polymeric binder has a sufficiently low composition by weight so that all of the polymer binder system is removed during decomposition and burn out. It should be noted that not all polymers in any weight percent are suitable for the present invention. Only polymers in the low weight percent that can be completely removed during decomposition and burn out are appropriate. See page 5, lines 20-31 and page 13 lines 16-27 for basis in the specification for the additional limitations presented in claims 10-13, and 43-46.

Claims 14, 15, 47 and 48 recite the use of an optional flow agent to promote good spreadability of the metallic powder blend on the laser sintering powder bed. See page 12, line 31 to page 13, line 2 for specific basis in the specification for these claims limitations.

Accordingly, there are two sets of appealed claims. Claims 1-7, 9-16, 32, 34 and 35 are drawn to a metallic powder blend for use in laser sintering with a high melting temperature fine metallic, intermetallic, or ceramic particulate of a weight percent greater than about 5 and less than about 15. Claims 36-51 are drawn to a similar metallic powder blend, but with a narrower range of high melting

temperature fine metallic, intermetallic, or ceramic particulate having a weight percent greater than about 5 and less than about 9.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-7, 9-11, 34-43, and 50-51

Claims 1-7, 9-11, 34-43, and 50-51are rejected under the provisions of 35 USC § 103(a) as being unpatentable over Gardner et al. (U.S. Patent No. 4,554,218). The Final Rejection maintained the rejection in the previous May 31, 2005 Office Action based on an argument that the "individual polymer binder's percentages as taught by the reference is still within the claimed range, the reference therefore teaches employing 'a polymer binder' having the claimed weight percentage." The prior rejection stated:

> "Gardner et al discloses a powder mixture for forming molded composite articles comprising 70 grams tungsten powder, 930 grams powdered A6 tool steel and 57 grams polymer binder which is equivalent powder mixture containing 6.6 wt% tungsten, 88 wt.% A6 tool steel and 5.4 wt.% polymer binder (column 16, lines 50-60). As for the binder Gardner et al teaches utilizing thermoplastic-thermoset binder mixture, which contains 29.6 parts bisphenol A epoxy resin, col 8, lines 62-66. Gardner et al therefore teach using "a polymeric binder" having a claimed weight percentage (5.5 wt.% x 0.296)."

The Patent Examiner is using the Gardner et al. reference as a teaching of a metallic powder mixture or blend for forming molded composite articles. Appellants do not take issue with that teaching.

Claims 12-13, 32, 45-46, and 49

Claims 12-13, 32, 45-46, and 49 are rejected under the provisions of 35 USC § 103(a) as being unpatentable over Gardner in view of Bray et al. (U.S. Patent No. 6,048,379). The Final Rejection maintained the previous rejection and argued that it would have been obvious to one of ordinary skill in the art to substitute the polymer binder of Gardner with the nylon binder of Bray in the powder blend of Gardner et al.

Claims 14-15, and 47-48

Claims 14-15, and 47-48 were rejected under the provisions of 35 USC § 103(a) as being unpatentable over Gardner et al in view of Luk (U.S. Patent No. 5,782,954), alleging it was obvious to combine a conventional flow agent with Gardner et al. to obtain the desired function.

ARGUMENT

I. Claims 1-7, 9-11, 34-43, and 50-51 Are Improperly Rejected Under this 35 USC § 103(a) Rejection

A. The Gardner et al. primary reference does not teach the claimed polymeric binder weight percent and therefore cannot be used as a basis for an obvious type rejection under the provisions of 35 USC § 103(a) for claims 1-7, 9-11, 34-43, and 50-51. The Final Rejection maintained the rejection in the previous May 31, 2005 Office Action based on an argument that the "individual polymer binder's percentages as taught by the reference is within the claimed range, the reference therefore teaches employing a 'polymer binder' having the claimed weight percentage."

Appellants submit that the Patent Examiner has misread what Gardner teaches with respect to polymer binder compositions and that therefore it cannot be used as a basis for an obvious type rejection under the provisions of 35 USC § 103(a). Gardner et al. does disclose a powder mixture for forming molded composite articles using steel powders, tungsten powders, and polymer binders. Appellants maintain, however, that the example cited in Gardner does not teach anything close to the compositions claimed in claims 1 and 36 of this application, especially with respect to the critical polymer binder weight percent.

Claims 1 and 36 of the instant application limits the binder composition via:

> "a polymeric binder from about 1.25 to about 2.25 percent by weight;"

Appellants respectfully submit that the teaching of Gardner et al. is not in this range.

The teaching example (Example 2) cited by the Patent Examiner (column 16, lines 50-60) specifically teaches 70 grams of tungsten powder, 920 grams of powdered A6 tool steel, and 57 grams of polymer binder. This totals 1057 grams, so that the binder comprises 5.4% by weight, which is clearly outside of the claimed polymer binder range. This is all that is taught by Example 2. The exact composition of that Example 2 binder is not given except with reference to Example 1. This reference to the composition of that binder is in the preamble to Example 2, which states "Using the method of example 1". But Example 1 simply teaches the use of Emerest 2642 – which is defined in column 8, lines 35-36 as a polyethelene glycol distearate – which is a thermoplastic and that is the only binder in that example.

B. The rejection then attempts to combine the above cited teaching of Example 2 with a discussion in column 8, lines 62-66 which teaches a thermoplastic-thermoset binder mixture, which significantly is not a thermoplastic as is used in Example 1. Further, the rejection incorrectly argues that this binder system is only 0.296 binder, therefore rendering the actual polymeric binder composition of Example 2 as 5.4% x .296 = 1.6% by weight.

First, it is submitted that this is improper user of hindsight to obtain the claimed combination. "The patentability of an invention is not to be viewed with hindsight or viewed after the event". *In re Warner and Warner 154 USPQ 173, 177 (CCPA 1967.* It is improper to "...use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." *In re Fine, 837 F.2d 1071,1075; 5 USPQ 2d 1596, 1600 (Fed Cir. 1988).* There must be some reason, suggestion, or motivation found in the prior art whereby a person of ordinary skill in the field of the invention would make the combination. *In re Oetiker 977 F2nd 1443; 24 USPQ 2d 1443, 1446 (Fed. Cir. 1992).* That

knowledge cannot come from the applicant's invention itself. Column 8, at lines 30-40, recites over ten different examples of potential binder systems. It is simply incorrect and clearly hindsight to try to read a specific different binder system from the general discussion in column 8 of the reference into the specific mixture in Example 2 which is using the method, and therefore the thermoplastic binder (Emerest 2642) of Example 1.

Secondly, it is important to note that even if Gardner et al.'s Example 2 had specifically called out the binder described in column 8, lines 62-66, which it does not, the binder mixture at that location in the reference is not just 29.6% binder. That example is clearly described as a thermoplastic-thermoset binder. The thermoplastic is Carbowax and the thermoset is the combination of Epon and Epi-cure. The complete binder is 29.6 parts "Epon", 9.1 parts "Epi-cure", and 29.25 parts "Carbowax, with 35.75 parts diluent. The sum is 103.7 parts mixture. The Epon, Epi-cure, and Carbowax are definitely part of the "binder mixture", so the total is actually 65.5% binder and 34.5 % diluent. Using that binder mixture in Example 2 would result in 5.4% x .655 = 3.5% by weight binder. This is well outside the limitation of claims 1 and 36 and teaches away from the claimed invention's purpose of limiting the amount of polymeric binder so that no binder system remains after decomposition and burn out to avoid residual hydrocarbon fragments that hamper outgassing that leads to surface blistering and potential delamination of the final article, as well as impeding the infiltration process used to densify the green part made from the metallic powder blend (see page 5, lines 20-31 of the specification). Therefore even allowing the quite improper combination of these two separate passages in the reference, the result is a binder outside the critical claimed range and contrary to the reason for the claimed invention's low binder percent composition by weight.

Even with another possible reading of the binder mixture in column 8, lines 62-66, the resulting binder weight percent is still outside the critical claimed range. This alternative, but still improper hindsight reading, would be that the Epi-cure,

is a curing agent and is not part of the binder mixture. That reading would result in the total mixture being 56.8% binder, 34.5% diluent and 8.7% curing agent. Even this reading results in the binder being 5.4% x .568 = 3.1% weight percent. This is still well outside the claim 1 limitation. There is simply no reading of the rejection's approach that puts it in the range of the claims 1 and 36 limitation, nor is there motivation to do so in the applied references.

The ordinary artisan in the laser sintering art, upon reading the teachings of the primary reference, would not have any motivation to select disparate passages from the reference to try to create the Appellants' claimed invention and it is impermissible to apply incomplete portions of a reference in hindsight to reconstruct the claimed invention. Even if there were motivation and it were permissible to cherry pick disparate passages of the reference, the resulting binder system would be outside the critical claimed range, contrary to the Examiner's erroneous contention and contrary to the invention's stated purpose of reducing the weight percent of the polymer binder system to permit all of the binder's removal during decomposition and burn out .

II. Claims 12-13, 32, 45-46, and 49 Are Improperly Rejected Under this 35 USC § 103(a) Rejection

The Gardner et al. primary reference does not teach the claimed polymeric binder weight percent and therefore cannot be used as a basis for an obviousness type rejection under the provisions of 35 USC § 103(a) for claims 1-7, 9-11, 34-43, and 50-51. The combination of the primary Gardner et al. reference in view of the secondary Bray et al. (U.S. Patent No. 6,048,379) reference cannot be used as a basis for an obvious type rejection under the provisions of 35 USC § 103(a) against claims 12-13, 32, 45-46, and 49.

For the reasons stated above Gardner et al. is not an appropriate teaching of the claimed invention and is improperly applied to the independent claims and their corresponding dependent claims.

III. Claims 14-15, and 47-48 Are Improperly Rejected Under this

35 USC § 103(a) Rejection

The Gardner et al. primary reference does not teach the claimed polymeric binder weight percent and therefore cannot be used as a basis for an obviousness type rejection under the provisions of 35 USC § 103(a) for claims 1-7, 9-11, 34-43, and 50-51. The combination of the primary Gardner et al. reference in view of the secondary Luk (U.S. Patent No. 5,782,954) reference cannot be used as a basis for an obvious type rejection under the provisions of 35 USC § 103(a) against claims 14-15, and 47.

Again, for the reasons stated above. Gardner et al. is not an appropriate teaching of the claimed invention and is improperly applied to the independent claims and their corresponding dependent claims.

CONCLUSION

Appellants respectfully request that the Board of Appeals reverse the outstanding rejection under 35 U.S.C. §103 of instant claims 1-7, 9-15, 32 and 34-51 on appeal. Any fees due with this Appeal Brief may be charged to Deposit Account 20-0900 under Customer Number 022514.

Respectfully submitted,

3D Systems, Inc.

December 2, 2005

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CLAIMS APPENDIX

The claims involved in the appeal are those of the amendment of December 3, 2004 and are as follows:

1. A powder blend for use in a laser sintering process comprising:

a steel alloy of about 88.75 to about 92.75 percent by weight selected from the group consisting of a mild steel alloy, a carbon steel and a stainless steel;

a polymeric binder from about 1.25 to about 2.25 percent by weight; and

a high melting temperature fine metallic, intermetallic, or ceramic particulate of greater than about 5 percent and less than about 15 percent by weight.

2. The powder blend according to claim 1 wherein the steel alloy ranges in size from less than about 90 microns to about 4 microns.

3. The powder blend according to claim 2 wherein the steel alloy ranges in size from less than about 75 microns to about 8 microns.

4. The powder blend according to claim 2 wherein the steel alloy is less than about 45 microns.

5. The powder blend according to claim 1 wherein the steel alloy is spherical.

6. The powder blend according to claim 2 wherein the high melting temperature fine metallic, intermetallic, or ceramic particulate has a particle size less than about 10 microns.

7. The powder blend according to claim 6 wherein the high melting temperature fine particulate has a particle size less than about 2 microns.

8. (canceled)

9. The powder blend according to claim 7 wherein the high melting temperature fine particulate comprises about 8 weight percent of the powder blend.

10. The powder blend according to claim 1 wherein the polymeric binder is a thermoplastic or a thermoset.

11. The powder blend according to claim 1 wherein the polymeric binder is selected from the group consisting of polyethylene, polypropylene, polyacetal, polymethacrylate, polyvinylacetate, nylon, wax, phenolic and combinations thereof.

12. The powder blend according to claim 11 wherein the polymeric binder is nylon.

13. The powder blend according to claim 12 wherein the nylon is one selected from the group consisting of polymers and co-polymers of nylon 6, nylon 9, nylon 10, nylon 11, and nylon 12.

14. The powder blend according to claim 1 further comprising a flow agent.

15. The powder blend according to claim 14 wherein the flow agent is fumed silica.

Claims 16-31 (canceled)

32. The powder blend according to claim 9 wherein the high melting temperature fine particulate is tungsten carbide.

Claim 33 (canceled)

34. The powder blend according to claim 1 wherein the high melting fine metallic, intermetallic, or ceramic particulate is selected from the group consisting of tungsten, tantalum, hafnium, rhenium, molybdenum, titanium aluminide, silicon carbide, tungsten carbide, boron carbide, alumina and diamond.

35. The powder blend according to claim 1 wherein the steel alloy is a mild steel alloy.

36. A powder blend for use in a laser sintering process comprising:

a spherical steel alloy of about 88.75 to about 92.75 percent by weight selected from the group consisting of a mild steel alloy, a carbon steel and a stainless steel;

a polymeric binder from about 1.25 to about 2.25 percent by weight; and

a high melting temperature fine metallic, intermetallic, or ceramic particulate of greater than about 5 percent and less than about 9 percent by weight.

37. The powder blend according to claim 36 wherein the spherical steel alloy ranges in size from less than about 90 microns to about 4 microns.

38. The powder blend according to claim 37 wherein the spherical steel alloy ranges in size from less than about 75 microns to about 8 microns.

39. The powder blend according to claim 2 wherein the spherical steel alloy is less than about 45 microns.

40. The powder blend according to claim 37 wherein the high melting temperature fine metallic, intermetallic, or ceramic particulate has a particle size less than about 10 microns.

41. The powder blend according to claim 40 wherein the high melting temperature fine particulate has a particle size less than about 2 microns.

42. The powder blend according to claim 40 wherein the high melting temperature fine particulate comprises about 8 weight percent of the powder blend.

43. The powder blend according to claim 36 wherein the polymeric binder is a thermoplastic or a thermoset.

44. The powder blend according to claim 36 wherein the polymeric binder is selected from the group consisting of polyethylene, polypropylene, polyacetal, polymethacrylate, polyvinylacetate, nylon, wax, phenolic and combinations thereof.

45. The powder blend according to claim 44 wherein the polymeric binder is nylon.

46. The powder blend according to claim 45 wherein the nylon is one selected from the group consisting of polymers and co-polymers of nylon 6, nylon 9, nylon 10, nylon 11, and nylon 12.

47. The powder blend according to claim 36 further comprising a flow agent.

48. The powder blend according to claim 47 wherein the flow agent is fumed silica.

49. The powder blend according to claim 42 wherein the high melting temperature fine particulate is tungsten carbide.

50. The powder blend according to claim 36 wherein the high melting fine metallic, intermetallic, or ceramic particulate is selected from the group consisting of tungsten, tantalum, hafnium, rhenium, molybdenum, titanium aluminide, silicon carbide, tungsten carbide, boron carbide, alumina and diamond.

51. The powder blend according to claim 36 wherein the steel alloy is a mild steel alloy